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Essential Oil Composition of *calotropis procera* (Aiton) Dryand

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Abstract. The use of herbal medicines is significant in healthcare initiatives, particularly in underdeveloped nations. All plants or parts of plants are thought to be possible sources of therapeutic substances, which includes a surprisingly comprehensive definition of what constitutes a medical plant. The literature and our own research both suggest that few studies exist that describe the chemical composition of *Calotropis procera* outside of Nigeria. Therefore, the purpose of this research was to describe the constituents of Calotropis procera essential oil, which is found in the northern part of Nigeria. Hydro distillation was used to distil the oil. An Agilent (Series MSD) gas chromatography 7890A/5975C linked mass spectrometer was used for the analysis of the oil. In the analysed essential oil, monoterpenes (60.4% of the oil) were the most prevalent compound, followed by other substances (23.81%) and sesquiterpenoids (15.67%). Phellandrenebeta-> (8.70), decanal4Z-> (8.48), and perilla ketone (7.77) % are the three most prevalent substances.This examination will provide as a starting point for more study on the subject plant.

Keywords. Oil, Food, Kaduna, Aiton.

1. Introduction

Plants have a crucial role in maintaining life on Earth by producing oxygen, food, medicine, fuel, and much more [1]. Despite all the study of medicinal plants, it is still widely acknowledged that they provide a rich source of chemical components for the creation of new medicines to treat a wide range of illnesses [2]. In many parts of the world, people are beginning to employ medicinal herbs alongside traditional medicine [3]. A well-established and severe quality evaluation system is required before the alleged benefits, authenticity, and safety of medicinal plants can be trusted [3]. Plant extracts used in traditional medicine have been shown to be both effective and safe in clinical trials [1]. Nigeria is among the most interesting and diversified countries in the world regarding tropical vegetation and medicinal plants [4]. One potential source of as-yet-undiscovered new lead compounds is Nigeria's enormous plant chemical diversity. To aid in quality control for identifying the plant species for potential use in the creation of herbal medications, herbal supplements, or modern drugs, this study aims to document the anatomical structure and chemical composition of Calotropis procera from Kaduna State, northern Nigeria. For botanists, pharmacognostic, Phyto chemists, and other experts working in the field of plant study, it is essential to name plants and comprehend how they relate to other species. For the identification and confirmation of unadulterated crude medicines, it is crucial to determine the taxonomic identity of medicinal plants accurately[5]. The success of agricultural and pharmaceutical endeavours, as well as environmental sustainability, depends on a deeper familiarity of plants in our environments. The taxonomical status of *C. procera* has become somewhat muddled. The rationale and criteria for determining the species restrictions are still up for discussion. Volatile and possessing a distinct aroma and flavour, essential oils are a by-product of the secondary metabolites found in plants [6]. Aromatic plants are commonly used because they contain volatile chemicals and essential oils [7]. Essential oils derived from plants have recently been used extensively in a variety of businesses, including the food and beverage industry, the cosmetics industry, and many others. Essential oils (EOs) and the chemicals that make them up could be used in food items because they are antifungal, antibacterial, and antioxidant [8]. There has been a worldwide search for natural products like natural EOs that have several applications due to the negative effects of synthetic antibacterial and antioxidant treatments [9]. EOs are employed as preservatives and antioxidants in food preparation, with effects ranging from moderate to powerful [6, 10].To our knowledge, and as indicated by the literature, there aren't many articles that detail the chemical makeup of *Calotropis procera* from other parts of the world, particularly Nigeria. As a result, the study sought to provide the chemical makeup of the essential oil of *Calotropis procera* from northern Nigeria.

2. Methods

2.1. Study Area
Kaduna is a state in northern Nigeria located at 10° 35' N, 7° 19' E, and it has a total area of 46,056 km^2 and a population of 6,066,562. While the weather changes with the seasons, the area generally falls into two categories: dry (October–May) and wet (June–August). Most of the population is made up of the nomadic Hausa and Fulani peoples [5]. The government, farming, livestock raising, fishing, and hunting all contribute significantly to their economy [5].

2.2. Sampling and Herbarium Deposition
This study analyzing recently collected leaves from several places in northern Nigeria. In April and May of 2020. Random samples of both fully developed and developing leaves were collected from the branches of many otherwise normal and healthy individuals. Mounted and pressed examples of Calotropis procera were placed in the herbarium at Ahmadu Bello University Zaria (ABU) in Zaria, Kaduna State, Nigeria (V/N ABU900218).

2.3. Essential Oil Distillation and Gas Chromatography Analysis
Fresh leaves were sifted, cleaned to remove any stains, and left to air dry before being converted into a powder. In a 2L Clevenger flask, 100 g of leaves were cultivated. After 5 hours of hydro distillation, the essential oil was filtered, dried with anhydrous sulphate, and then frozen at -4 degrees Celsius for additional analysis [7]. An Agilent (Series MSD) gas chromatography 7890A/5975C linked mass spectrometer was used for the experiment. The chemical mixtures were separated on an HP-5MS 30 m x 0.25 mm column at 60 °C for 10 min, then at 230 °C for 1 min at 3 °C/min with a 1 min hold. Helium flow through the injector was 1 mL/min at 245 °C. According to [7]., the ion source and analyser for 70 e V MS were run at 260 °C.

3. Results
Table 1 demonstrate that 34 compounds were discovered, accounting for 99.88% of the total. Monoterpene compounds were the most numerous in the essential oil studied (60.4%), followed by

other compounds (23.81%), and sesquiterpenoids (15.67%). The most abundant compounds are (Figure 1) Phellandrenebeta-> (8.70), Decenal4Z-> (8.48), and Perilla ketone (7.77) %, with the rest compounds falling below 7% (Table 1).

Table 1. Essential oil chemical composition of *Calotropis procera*.

S/N	RT	Compound	Formula	Area
1	7.7424	Tricyclene	$C_{10}H_{16}$	5.53
2	8.6381	Terpinolene	$C_{10}H_{16}O$	1.98
3	8.7569	Dodecanal	$C_{12}H_{24}O$	5.53
4	9.1297	Dodecanal	$C_{12}H_{24}O$	4.95
5	9.4468	Tumerol<ar->	$C_{15}H_{20}O$	2.17
6	10.1526	Ocimene<(E)-beta->	$C_{10}H_{16}$	2.42
7	10.8576	Trycyclene	$C_{10}H_{16}$	5.53
8	10.8867	Phellandrene<beta->	$C_{10}H_{16}$	8.70
9	11.0077	Mentha-2,4(8)-diene<para->	$C_{10}H_{16}$	5.94
10	11.2329	Sabinol<trans->	$C_{10}H_{16}O$	3.10
11	11.3741	Hepten-2-ol<6-methyl-5->	$C_8H_{16}O$	1.47
12	12.9821	Perilla ketone	$C_{10}H_{14}O_2$	7.77
13	13.1916	Sabinene hydrate<cis->	$C_{10}H_{18}O$	3.20
14	13.2202	Elemene<delta->	$C_{15}H_{24}$	1.77
15	14.2137	Decenal<4Z->	$C_{10}H_{18}O$	8.48
16	17.359	Undecanal	$C_{11}H_{22}O$	0.45
17	17.4203	Mentha-2,8-dien-1-ol<cis-para->	$C_{10}H_{16}O$	1.93
18	17.5452	Mentha-2,8-dien-1-ol<cis-para->	$C_{10}H_{16}O$	2.93
19	19.8904	Verbeol<cis->	$C_{10}H_{16}O$	1.07
20	20.0838	Menthatriene<1,3,8-par-> a->	$C_{10}H_{14}$	1.86
21	20.1061	Damcone<(Z)-alpha->a->		2.64
22	23.117	Butanoate<3-methyl-2-butenyl	$C_9H_{16}O_2$	2.64
23	23.7002	Muurola-3,5-diene<trans->	$C_{15}H_{24}$	1.78
24	26.4679	Hexenyl cinnamate<3Z->	$C_{15}H_{18}O_2$	3.25
25	34.6375	Siliphinene		0.18
26	35.9826	Chenopodiol-6-acetate<beta->	$C_{17}H_{28}O_3$	0.58
27	36.2182	Linalool propanoate	$C_{14}H_{24}O_2$	1.73
28	37.3934	Guaiene<cis-beta->	$C_{15}H_{24}$	2.51
29	37.479	Guaiene<alpha->	$C_{15}H_{24}$	0.20
30	37.5378	Selinene<beta->	$C_{15}H_{24}$	1.37
31	37.8189	Epizonarene	$C_{15}H_{24}$	2.88
32	37.927	Copaene<beta->	$C_{15}H_{24}$	0.90
33	38.086	Muurola-3,5-diene<trans->	$C_{15}H_{24}$	2.78
34	38.2052	Occidol acetate	$C_{17}H_{24}O_2$	3.51
35		*Monoterpenes compound*		*60.4*
36		*Sesquiterpenes compound*		*15.67*
37		*Others*		*23.81*
38		*Total*		*99.88*

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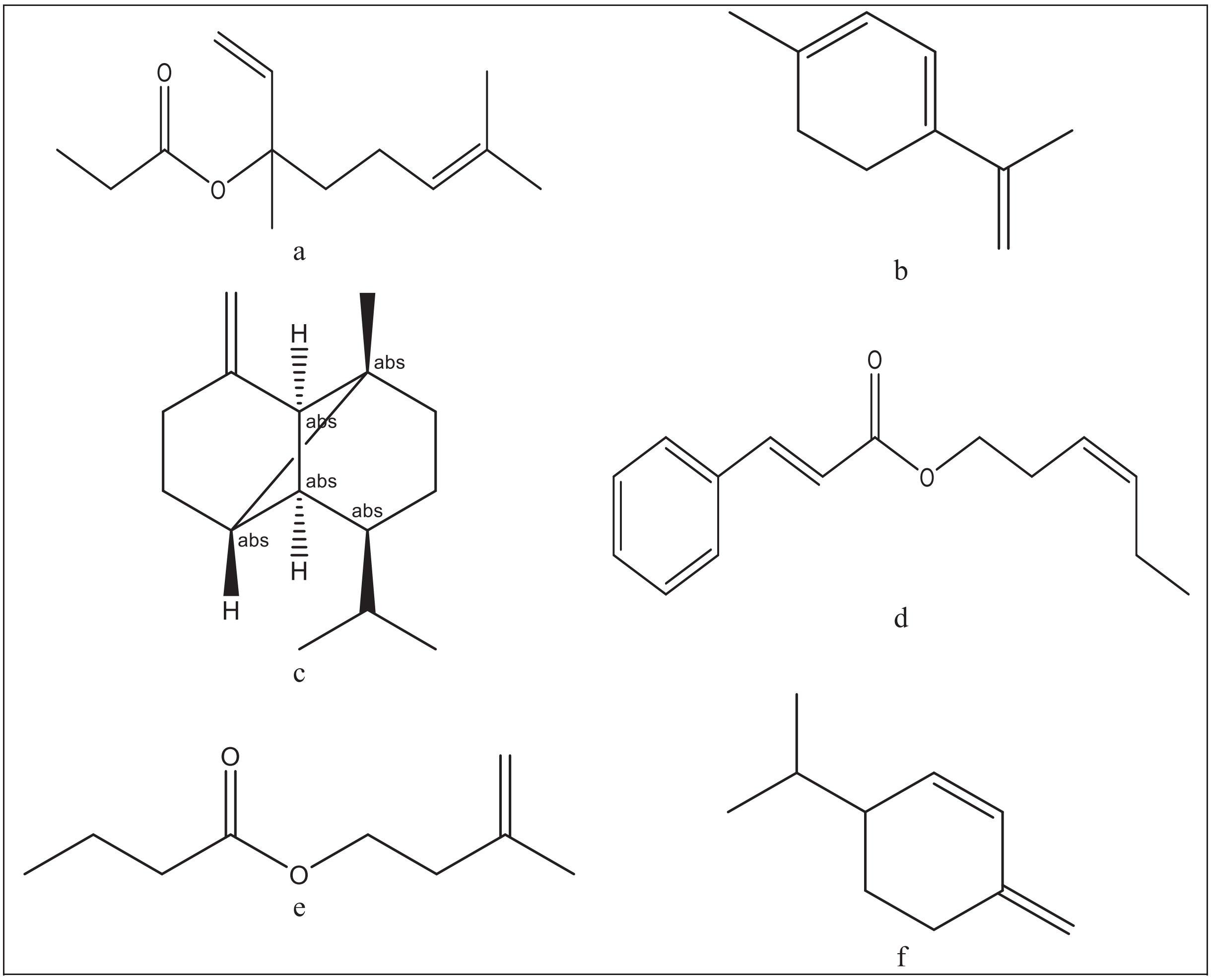

Figure 1. Structures of some of the compound identified from essential oil of *Calotropis procera*; (a) Linalool propanoate, (b) 1,3,8-p-Menthatriene, (c) (-)-beta-Copaene (d) (d) (Z)-3-Hexenyl cinnamate and (e) 3-methyl-3-butenyl butanoate (f) beta-Phellandrene.

4. Discussion

Herbal or modern medicines made from plants must come from authentic, risk-free sources. To ensure the safety and efficacy of modern medications and herbal supplements, quality control in ethnopharmacology is essential. A scientific understanding of the chemical composition of medicinal plants is necessary for identification. Morphological characteristics have long been relied upon in plant classification [11]. Plant-derived natural material can be used to create chemicals with a wide range of physiological and bioactive properties [12]. Plants have both a primary and a secondary metabolism [12]. The primary metabolism produces compounds used in the biosynthetic process, whereas the secondary metabolism produces medicinally active molecules. Each medicinal plant must be chemically identified. There were 34 compounds found, accounting for 99.88% of the total. The most abundant components in the essential oil tested were monoterpenes (60.4%), followed by other compounds (23.81%), and sesquiterpenoids (15.67%). Phellandrenebeta-> (8.70), Decenal4Z-> (8.48), and Perilla ketone (7.77) % are the most prevalent chemicals, with the rest lying below 7%. The chemical makeup of essential oils from the same species can vary depending on when and where they were harvested [13]. Calotropis procera is a plant native to northern Nigeria, however its chemical make-up is unknown currently. Considering anecdotal reports that the plant has been used to treat and manage cancer, malaria, typhoid fever, and other diseases, we set out to learn more about the oil it produces. The essential oil extracted from Calotropis procera leaves is analysed in detail for its chemical composition. This work lays the groundwork for additional studies of the plant in question.

Conclusion

Plants provide a significant portion of the diet for many prehistoric human communities, particularly those in Africa. The use of plants is highly regarded in traditional medicine. For thousands of years, people have relied on aromatic and medicinal herbs to cure a wide range of conditions. The chemical composition of Calotropis procera in northern Nigeria has not been reported in the literature, as far as we are aware. Cancer, malaria, typhoid fever, and many other ailments have all benefited from the plant's traditional use as a treatment or preventative measure. However, the composition of the oil extracted from the plant is poorly understood, prompting the present investigation. This research reports on the chemical make-up of the essential oil derived from the leaves of the Calotropis procera tree, native to northern Nigeria. Monoterpenes (60.4% of the oil) were the most common component, followed by other compounds (23.81%) and sesquiterpenoids (15.67%) in the evaluated essential oil. The three most common compounds are phellandrenebeta-> (8.70), decanal4Z-> (8.48), and perilla ketone (7.77) %. This investigation will serve as a springboard for further research on the plant in question.

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